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One-Way Valved Speech Bulb Obturator Using a Tracheoesophageal Prosthesis

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Abstract

This article describes the fabrication procedures to create a one-way valved speech bulb obturator.

Patients with palatal velopharyngeal insufficiency (VPI) due to a soft palate resection will have highly compromised speech due to excessive air emission into the nasal cavity, also known as hypernasality. Additionally, improper valving during the swallowing of food and drink will result in moderate to severe injection and retention of debris in the nasal cavity. These objectionable results will cause the patients to avoid conversation, limit the nutritional intake of food to a liquid diet, and adversely affect their quality of life.[1-4]

To improve the function of patients with VPI, numerous prostheses and devices have been used with varying success. The primary goal of these devices is to obturate the defect during swallowing and concurrently provide the necessary valving for speech; however, many patients heal with nonfunctional soft palate defect walls due to the surgical resection and/or postresection radiotherapy. Thus, there is not a sphincter-like action of the posterior, anterior, or lateral walls around the prosthesis, resulting in less than optimal function during speech and swallowing.[5-13]

This technique article is based on a patient treated at our clinic beginning in September 2010. The 69-year-old male patient presented with a medical history of nasopharyngeal squamous cell carcinoma in December 1986, followed in January–February by adjuvant chemotherapy with cisplatin and 5-FU. Then in April–May he had radiation therapy approximating 8500 centigray. In 1997, he reported iatrogenic perforation of his soft palate associated with the administration of general anesthesia during a medical procedure, necessitating the resection of his soft palate.

The objective of this article is to describe an innovative technique to create a one-way valved speech bulb obturator using a tracheoesophageal prosthesis (Low Pressure Voice

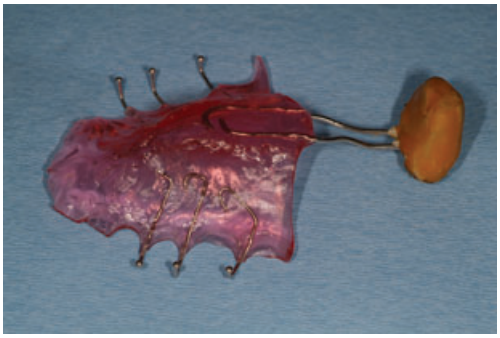

Figure 1 Tracing of defect with modeling plastic impression compound and functional wax.

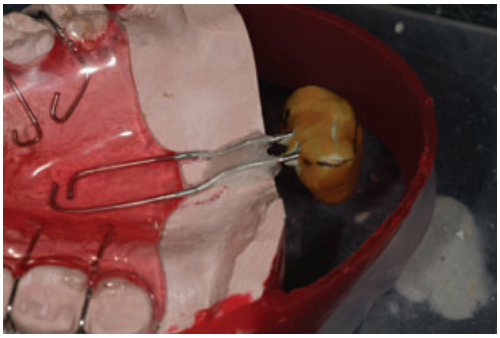

Figure 2 Boxing for corrected cast fabrication.

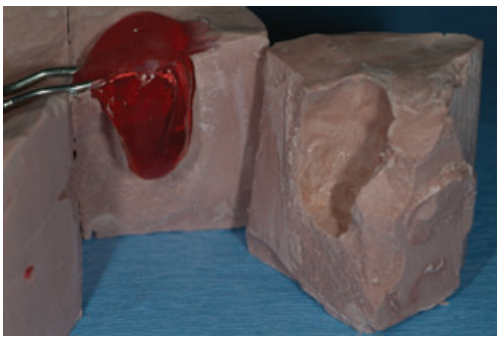

Figure 3 Speech obturator bulb area poured in acrylic resin and processed.

Prosthesis, Blom-Singer 20 French, International Healthcare Technologies, Carpinteria, CA). The aim of using this valve is to provide an open nasal airway during inspiration. The valve has a small internal flap valve incorporated into the rubber housing that opens with light air movement. Upon cessation of nasal breathing or during the process of swallowing, the valve closes,

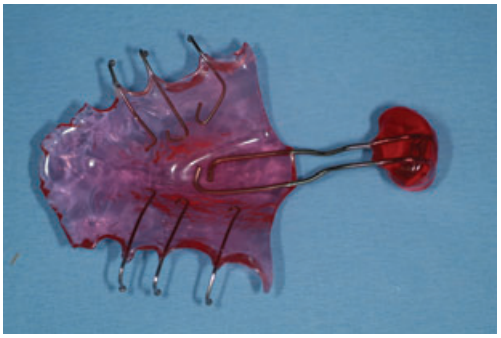

Figure 4 Completed solid speech bulb obturator.

Figure 5 Blom-Singer® 20 French, low pressure voice prosthesis.

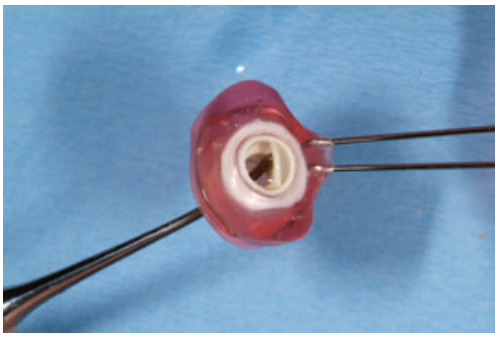

Figure 6 One-way valve opened.

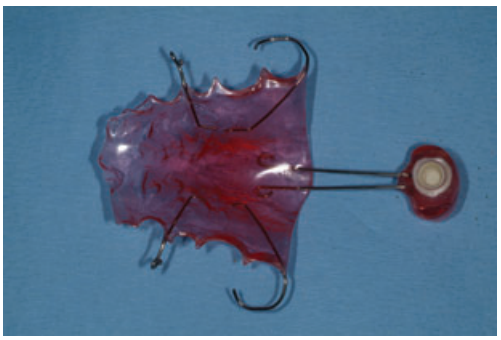

Figure 7 One-way valved speech bulb obturator.

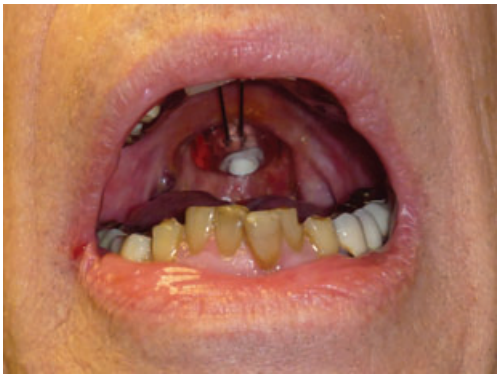

Figure 8 One-way valved speech bulb obturator device 6 weeks postinsertion.

thus preventing regurgitation of oral matter into the nasal cavity. Additionally, the closed valve prevents extreme nasal air emission during speech, diminishing hypernasal speech and improving oration force and volume.

Technique

1. Maxillary and mandibular impressions were made using alginate (Jeltrate regular set, Dentsply Caulk, Milford, DE) and modeling plastic impression compound (MPIC) (Red Impression Compound Type I, Kerr USA, Romulus MI) to extend the stock metal tray toward the anterior defect margin.
2. Casts were then poured in Type IV dental stone (Silky Rock, Whip Mix Corp, Louisville, KY).
3. On the maxillary cast a complete palate acrylic resin device was fabricated with multiple wrought wire retention clasps (Great Lakes Orthodontics, Tonawanda, NY). A 0.032 wire loop was extended distally approximating the location of the defect. Although this patient's lateral pharyngeal tissues were immobile, complete obturation of this type of defect necessitates clasping of multiple teeth, adequate anterior indirect retention, and a rigid connector to the obturator portion. These features will ensure proper bulb orientation, prevent movement, and minimize tissue abrasion during function.[14]
4. The device was then inserted. The wire loop was adjusted to be approximately 2 to 3 mm into the pharyngeal defect and bent upwards toward the nasopharynx. Then gray MPIC was carefully added to the wire, and the defect was completely traced and extended superiorly 10 to 12 mm above the palatal plane. Speech and swallowing was assessed during this process until hyponasality was observed.
5. The MPIC was then trimmed 1 mm circumferentially, and functional impression wax was added to obtain the final impression (D-R Miner Korecta Wax #4, Medford, OR). Again, speech and swallowing were assessed by the authors. Again, it was noted that the lateral walls of the defect area were immobile and nonfunctional (Fig 1).
6. The device with the final impression was placed on the original cast, and a corrected cast was created to include the impression of the defect. It was noted that the defect volume measured 12 mm in depth, 16 mm in width, and 12 mm high (Fig 2).
7. To create the obturator bulb, the soft palate defect area was poured in the same acrylic resin as the palatal device and cured in a pressure pot at 20 psi for 20 minutes. This created the first speech bulb obturator for the patient to use for comparison with the next device (Figs 3, 4).
8. Another device was fabricated in the same fashion as the above device; however, the center of the bulb was hollowed out to create a tube in the acrylic resin for the insertion of a one-way valve (Blom-Singer 20 French, Low Pressure Voice Prosthesis). The one-way valve measured 7 mm in diameter (external dimension) and 10 mm long and had a superior and inferior flange (Fig 5). The valve flanges were trimmed circumferentially to be within the confines of the obturator. The valve was attached within the bulb with acrylic resin so that the air flow would be directed from the nasal cavity into the oral pharynx (Figs 5–7).
9. Both devices were delivered to the patient. His speech and swallowing were assessed by a speech pathologist. Bulb fit to the defect was assessed using a flexible fiber optic nasoendoscope.[9,10] The one-way valved device was adjusted for optimum speech and to closely fit to the defect (Fig 8). The nonvalved device was adjusted to allow for some nasal air intake and emission lateral to the bulb. At the time of insertion, it was noted that the nonvalved device adversely affected speech and swallowing, causing slight hypernasal speech and leakage of food and liquid into the nasal cavity.
10. The patient was requested to alternate the wearing of the different devices every other week and report back to our clinic in 3 weeks, in 6 weeks, and in 6 months. He kept a daily log during this follow-up period and was asked to select the device he preferred. He related a preference for the device with the one-way valve and returned the nonvalved device. Subjectively, he felt an improvement with his speech and swallowing.

Summary

This technique article describes the obturation of a large soft palate defect with velopharyngeal incompetence using a one-way valved prosthesis. Our results showed positive improvement in nasal breathing, swallowing, and speech. A limitation of this technique is that it incurs additional cost (approximately $225) and laboratory time to prepare and insert the tracheoesophageal prosthesis. Furthermore, evaluation with a nasoendoscope may not be possible in all clinics, but subjective assessment may not be sufficient to determine border seal and fluid leakage with this type of prosthesis.[15] Thus, close coordination with a speech pathologist is recommended. Further investigations are necessary on a broader group of patients to determine the effectiveness of the device and any further limitations associated with its use.

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